IWR-MAIN Background

The IWR-MAIN Water Demand Analysis Software forecasts urban water demand and efficiency savings. For the California Water Plan Update 2003, IWR-MAIN will forecast urban water demand for 2030, based on the values developed in Table 1. IWR-MAIN could potentially be used to analyze the response packages as well.

IWR-MAIN's ability to consider multiple factors and project water use drivers, break down demand management, and perform sensitivity analyses has made it a choice of water planners nationwide. It is flexible and allows the user to choose from different types of models, such as linear or multiplicative. The model consists of two parts: The Forecast Manager, for urban water use forecasting, and the Conservation Manager, used for demand management (conservation) forecasting.

The Forecast Manager

The Forecast Manager projects urban water use by customer sector by modeling water use patterns. It analyzes the variables involved that affect the rate of water use (per household for the residential sector, and per employee for the industrial sector). These drivers may include household income, household size, housing density, weather conditions, and the price of water and wastewater services.

Disaggregation of Data

Disaggregation of data occurs (i.e., data can be broken down) spatially, seasonally, and by use.

Spatial Use: The modeler is able to define study areas regionally, e.g., by geographic area, county, watershed basin, or water district boundaries. This allows the planner to account for regional population growth, as well as variances in socioeconomic attributes, and seasonal variations in economic and climatic conditions.

Seasonal Use: Since use varies by season, seasonal data disaggregation forecasts water use according to:

- annual average-daily demands,
- summer or winter average-daily demands,
- maximum daily demands, and
- indoor vs. outdoor water use per household.

Finally, the model can identify demand management techniques for peak use.

Water Users: The model can identify major sectors of water users. These include residential, non-residential (manufacturing, commercial, and governmental), public, and other. In this case, other refers to fire hydrant usage, system flushing, or unaccounted for water usage such as system leakage. If data is available, further disaggregation can occur such as splitting residential into single-family use and multiple-family use. The non-residential sector can further be divided using the North American Industry Classification System (NAIC) codes. These codes allow disaggregation of commercial and industrial users (such as restaurant, dry cleaners, clothing manufacturer). The

model can display variations in water use by customer type, as well as variations in customer group growth rates. This data can assist the modeler in targeting demand management programs.

The IWR-MAIN model provides the user with the ability to study different scenarios by making changes in the variables of water demand, and to analyze long-term water demand impacts. This sensitivity analysis allows the modeler to view different futures based on the changes of one or more attributes.

The Conservation Manager

The Conservation Manager estimates water use efficiency savings by specific end uses. The model can forecast long-term water savings of different demand management (conservation) practices. These savings can then be integrated into Forecast Manager to develop long-term forecasts of water demand. In addition, the Conservation Manager can change a baseline forecast to show how water use efficiency can make an impact on water use.

End Use: Disaggregation by end use can be applied to the demand management side of IWR-MAIN as well. It can be as simple as splitting indoor versus outdoor usage, to a full disaggregation showing indoor water usage as toilets, urinals, showers, bathtubs, faucets, dishwasher, washing machine, boiler feed, process water, cooling, evaporative cooler, and other. Outdoor usage may be split out to landscape irrigation, vehicle washing, swimming pools, and other.

Conservation: Plumbing retrofit campaigns, conservation audits, rebate programs, and landscape replacement can be projected by active conservation options. Passive conservation flexibility in the model includes: indoor plumbing code for new construction, point-of-sale plumbing fixture ordinances, residential and commercial landscaping ordinances, and water waste ordinances.

Other Options: The modeler can specify end use parameters by user sector. Intensity of use (e.g., how often a toilet is flushed) and presence of end uses, as well as levels of efficiency for each use (e.g., non-conserving, ultra-conserving) and the saturation level (e.g., how many non-conserving and ultra-conserving toilets are being used) can be determined.

Data Collection

The Department of Water Resources annually surveys urban water agencies in all regions of the state. Surveys collect monthly data on water production and deliveries disaggregated by customer class. This regional survey database, combined with user-defined inputs, will allow the Department to estimate baseline urban water use (the “where are we now” case).

Using IWR-MAIN for Update 2003

IWR-MAIN will be used to prepare urban water use forecasts to 2030 for each of the four water use levels shown in “Table 1”, and additional forecasts to estimate the effects

conservation measures included in the various response packages. Input to IWR-MAIN will be based on the "Table 1" assumptions, which include: total population, population density, population distribution, commercial activity, commercial activity mix, industrial activity, industrial activity mix, naturally occurring conservation, water use efficiency, per capita income, and rate structure. The output of IWR-MAIN will be used as input to LCPSIM, and will be used for water supplies and balances. In future Updates, CALSIM II will use IWR-MAIN as an input.

Validation of the IWR-MAIN Model

Water agencies across the United States have validated IWR-MAIN through actual use and literature review. Agencies that utilize IWR-MAIN include the San Diego County Water authority, Metropolitan Water District of Southern California, the Oklahoma Water Resources Board, the Phoenix Department of Water and Wastewater, Indianapolis Water Company, El Paso Water Utility, city of Binghamton, NY, Springfield City Water, Southwest Florida Water Management District, and Las Vegas Valley Water District.

<table>
<tr><th colspan="2">IWR-MAIN Inputs</th></tr>
<tr><td>Water Use:
▪ Number of accounts by type
▪ Water use by customer class
- Single family
- Multiple family
- Commercial
- Industrial
- Landscape
- Unmetered/Unaccounted</td><td>Water Use Efficiency:
▪ Mechanical measurements
▪ Fraction of units in each efficiency class
▪ Intensity values
▪ Presence of end use
▪ Natural replacement rates
▪ Compliance rates</td></tr>
<tr><td>Climate/Weather Inputs:
▪ Average daily maximum temperature
▪ Precipitation
▪ Cooling degree days</td><td rowspan="2">Socioeconomic Inputs:
▪ Total population
▪ Persons per household
▪ Housing units
▪ Housing density
▪ Commercial employment
▪ Industrial employment
▪ Residential marginal price
▪ Household income</td></tr>
<tr><td>Model Parameters:
▪ Elasticity values of:
- Median household income
- Housing density
- Persons per household
- Marginal price
- Average daily maximum temperature
- Total precipitation
- Cooling degree days</td></tr>
</table>

Reference:

Baumann, Duane, Boland, John, and Hanemann, W. Michael. 1998. Urban Water Demand Management and Planning. New York: McGraw-Hill.

IWR-Main Background/Summary Chart
Jun 18, 2002

This chart highlights IWR-Main assumptions that the Modeling Work Group identified that Advisory Committee members should be aware of and review as modeling work moves forward. If you have questions regarding these assumptions, please contact facilitator Gina Bartlett (tel: 415-255-6805 or gbartlett@pacbell.net). The Modeling Work Group consists of staff and Advisory Committee members.

IWR-Main Assumption For Review	Issue	Modeling Work Group Proposal
End-use disaggregation	IWR-MAIN has the capability to disaggregate (break down) data. In particular, the Conservation Manager can estimate water use efficiency savings by specific end uses. It can be as simple as splitting indoor vs. outdoor usage, to a full disaggregation showing usage such as toilets, urinals, showers, bathtubs, faucets, dishwasher, etc.	
Assumptions about efficiencies (how much you can get from technology change)	In order to quantify efficiencies, a literature review will be completed and reports will be reviewed (e.g., from CUWA and the CUWCC). Naturally Occurring Conservation will be explicitly modeled to avoid double-counting conservation savings.	
Numeric assumptions	The Department of Water Resources annually surveys urban water agencies and collects monthly data on water production and deliveries disaggregated by customer class. This data, along with socioeconomic data (such as from the Census) will be used to establish current water use per counting unit.	

IWR-Main Assumption For Review	Issue	Modeling Work Group Proposal
Percentage moving to high efficiency	IWR-MAIN keeps track of how each user sector moves to each level of efficiency, whether by active conservation (such as rebate programs), or passive conservation (such as changes in the plumbing code). IWR-MAIN models these conservation levels explicitly.	
Underlying population forecasts	Population counts will be used from different sources. DOF projections are used for total population. The U.S. Census, county councils of government, and private entities (such as the Center for Continuing Study of the California Economy) will be used for socioeconomic data (e.g., employment, persons per household).	